REMARKS

This reply is submitted in response to the Office Action of July 14, 2004. The amendments above and remarks that follow address the points raised in the Office Action, and thereby, place this application in condition for allowance.

Drawings

The drawings are amended to add reference characters as required.

Specification

The specification is amended as required in accordance with the changes to the drawings. Paragraph 4 is added to page 13 describing Figs. 7 and 8, and corresponds to the text regarding these figures on page 6 of the specification.

The paragraphs on page 3 that duplicate the description of patent 3,860,300 and 3,937,148 are deleted from the specification.

Claims

The Office Action rejects claims 11 and 12 under 35 U.S.C. § 102(b) as being anticipated by Lamb (U.S. Patent No. 3,912,992). Claims 11-13 are rejected under 35 U.S.C. § 102(e) as being anticipated by Okano et al. (U.S. Patent No. 6,418,857). Claims 1-3, 4-8, 10 and 13 are rejected under 35 U.S.C.§ 103(a) as being unpatentable over Lamb in view of Morishita et al (U.S. Patent No. 4,972,779. The Office Action indicates that claims 4 and 9 are allowable.

At the outset, claims 4 and 9 are rewritten in independent form as new claims 17 and 18, and are allowable as stated in the Office Action.

The independent claims are amended to further emphasize patentability over the prior art. For example, claims 1, 11 and 13 are amended to clarify that one or more of the magnet arrays effects (1) magnetic attraction forces to at least one guideway rail, (2) lateral restoring forces on the vehicle *sufficient to provide guidance for the vehicle without the need for additional*

structure to provide such guidance, and (3) longitudinal forces in response to electrical current in one or more of the windings.

Claims 14, 15 and 16 parallel claims 1, 11 and 13, with alternate recitation providing that one or more of the magnet arrays effects, among other things, lateral restoring forces of at least 0.4 g on the vehicle to effect guidance thereof.

The amended claims are patentably distinct from the prior art. Specifically, Lamb purports to teach a parallel connected linear electric motor system in which the speed of the moving member and the force applied to the moving member of the motor system may be easily controlled. Though it does have an arrangement of a guideway and magnets, it does not teach or suggest a vehicle comprising one or more arrays of magnets which effects magnetic attraction forces to at least one guideway rail, lateral restoring forces on the vehicle free of additional structures, and longitudinal forces in response to electrical current in one or more of the windings. In fact, Lamb uses additional structures to effect lateral restoring forces, namely, the magnetic sensors S81, S82, S91, S92...S142 (Fig. 3), which are used to control the motion of the vehicle along the track (see specification, col. 5, lines 28-31). For these reasons, among others, Lamb does not teach or suggest claims 1, 11, and 13.

Lamb similarly fails to teach of suggest the subject matter of claims 14, 15, and 16, since that publication fails to teach use of a magnetic structure that, among other things, effects (1) magnetic attraction forces to at least one guideway rail, (2) lateral restoring forces on the vehicle *with a lateral guidance of about 0.4 g*, and (3) longitudinal forces in response to electrical current in one or more of the windings.

Okano purports to teach a superconductive magnetic levitation transportation system, where a transportation vehicle travels by potential energy by a level difference on a magnetic levitation guide disposed in a vacuum transportation passage. A series of magnets disposed along the guide are used to move the vehicle along the guide using potential energy, and a superconductive member which levitates the vehicle. Okano does not teach or suggest a vehicle comprising one or more arrays of magnets which effects the following forces: (1) magnetic attraction forces to at least one guideway rail, (2) lateral restoring forces on the vehicle sufficient to provide guidance for the vehicle without the need for additional structure to provide such

guidance, and (3) longitudinal forces in response to electrical current in one or more of the windings. Okano uses the series of magnets *and* the superconductive member to achieve these forces, unlike the system in the independent claims of the application.

Okabo similarly fails to teach of suggest the subject matter of claims 14, 15, and 16, since that publication fails to teach use of a magnetic structure that, among other things, effects (1) magnetic attraction forces to at least one guideway rail, (2) lateral restoring forces on the vehicle *with a lateral guidance of about 0.4 g*, and (3) longitudinal forces in response to electrical current in one or more of the windings.

Morishita purports to teach a transportation system which floats a carrier. Though the system does have an arrangement of a guideway and magnets, it does not teach or suggest a vehicle comprising one or more arrays of magnets which effect all of the following forces: (1) magnetic attraction forces to at least one guideway rail, (2) lateral restoring forces on the vehicle sufficient to provide guidance for the vehicle without the need for additional structure to provide such guidance, and (3) longitudinal forces in response to electrical current in one or more of the windings. The system uses additional structure, such as the four wheels 64 (Fig. 1) to protect the carrier and act as a lateral restoring force when the carrier has come to a stop and the magnets fail to stabilize the carrier.

Morishita similarly fails to teach of suggest the subject matter of claims 14, 15, and 16, since that publication fails to teach use of a magnetic structure that, among other things, effects (1) magnetic attraction forces to at least one guideway rail, (2) lateral restoring forces on the vehicle *with a lateral guidance of about 0.4 g*, and (3) longitudinal forces in response to electrical current in one or more of the windings.

Hence, independent claim 1, 11, and 13-18, and dependent claim 2, 3, 5-8, 10, and 12, are patentable over the cited references.

Conclusion

In view of the above amendment, Applicant respectfully submits that the claimed invention is patentable. Applicant respectfully requests reconsideration of all claims in light of the above remarks and allowance thereof.

The Examiner is also kindly requested to contact the undersigned if such would expedite examination and allowance of the application.

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Respectfully submitted,

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APPENDIX

Marked up version of replacement paragraph beginning at line 13 on page 8

--Figure 1 shows a cross-section of the baseline suspension design 10 in a system according to the invention. The vehicle 12 is supported by a string of magnets 18 on each side and these magnets create attractive forces to the laminated steel rails 14 on the guideway 24. Also shown is box beam 22.. The dimensions shown in Fig. 1 were chosen with several factors in mind, e g.,--

Marked up version of replacement paragraph beginning at line 25 on page 9

--Figure 3 is a graph depicting the suspension force 30 and guidance force 32 as a function of lateral displacement for a 1-wavelength (0.5 meter) section of vehicle magnets and for an 80 mm rail width, for a system such as described above. This graph was generated for magnets with an energy product of 40 mega Gauss Oersted (MGO) using 3D finite element analysis with periodic boundary conditions. The normal operation is with 20 mm vertical displacement and zero horizontal displacement and then the suspension force is 2,700 N per wavelength, as shown in the graph. The suspension will then support 550 kg of mass per meter of length of the magnet pods. The 2 half-magnets on the ends of the pods will produce additional lift of 630 N total for magnets with the dimensions and locations shown in Fig. 2b. Four pods, each with a length of 3 meters, will then lift 6,700 kg, the approximate mass of a normally loaded (i.e. 75% of the seats filled), small bus size vehicle.--

Marked up version of replacement paragraph beginning at line 1 on page 12

--The relative dimensions shown in Fig. 2b were chosen according to this criterion. A magnet pod 40 with four full magnets 42 and the two end magnets 44 is shown in Fig. 4.—

Marked up version of replacement paragraph beginning at line 4 on page 12

--In Fig. 2b, the end magnets 26 are not full height and do not have control coils. The reduced height reduces the attractive force when the magnet gap is small and this reduces the peak current required in the control coils. In some embodiments, a control coil is placed around the end magnets. A design of the end magnets could be quite different if the magnet array is very short or if higher suspension force is required, and such is envisioned herein.--

Marked up version of replacement paragraph beginning at line 37 on page 12

--Fig. 5 is a simplified block diagram of the control system for a typical pod according to the invention. The pod can have any number of control coils, here designated n, each controlled by an H-bridge <u>48</u>, which is, in turn, controlled by a digital signal processor <u>50</u> (DSP). Gap and acceleration sensors <u>52</u> at each end of the pod provide the sensor input needed to maintain a stable gap. In practice there can be more than one processor so that there is redundancy in case of failure of the control system.--

Marked up version of replacement paragraph beginning at line 18 on page 13

--Position sensing <u>56</u> in the illustrated embodiment is achieved as described in US Patent 6,011,508, *Accurate Position Sensing and Communications for Guideway Operated Vehicles*, the teachings of which are incorporated herein by reference; other mechanisms (known in the art or otherwise) can be used as well. The position sensing system is integrated into the LSM and this controls the switching of the inverters. When the required thrust is low it is preferable to operate the inverter so that the current is in phase with the motor back-voltage and the sign of the current determines whether the motor is providing forward or reverse thrust. Operating in-phase minimizes power dissipation in the LSM winding.--

Marked up version of replacement paragraph beginning at line 27 on page 13

--<u>Fig. 7 depicts a vehicle 70 according to the invention with four pods that pivot in two dimensions in order to allow negotiating horizontal and vertical turns. Fig. 8 shows how the magnet pods, such as those illustrated in Fig. 7, can be attached to a vehicle 80 according to the invention. Fig. 8 also shows optional mechanical mechanisms according to the invention that damp oscillations of the pods with respect to the vehicle.</u>--

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AMENDMENTS TO THE DRAWINGS

The attached sheets of drawings includes changes to Figs. 1-8.

Attachment: 8 Replacement sheet

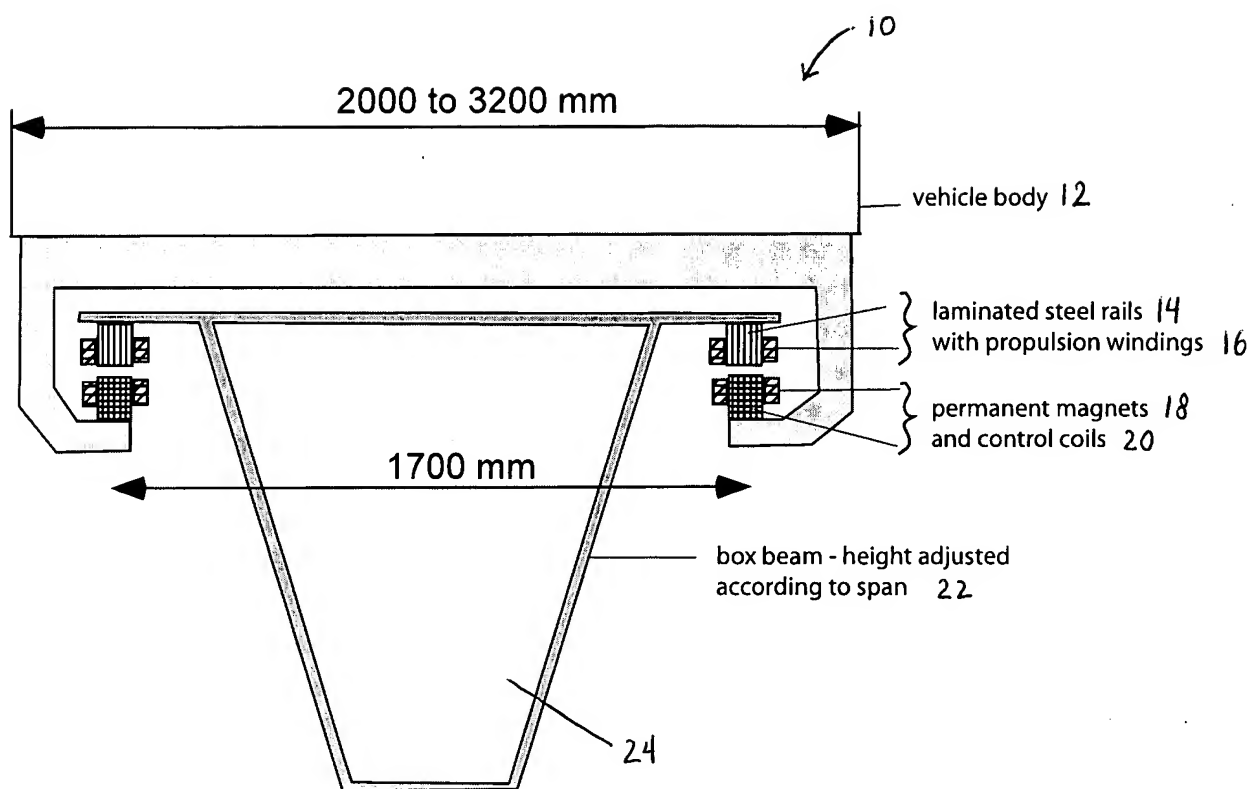   8 Annotated sheet showing changes
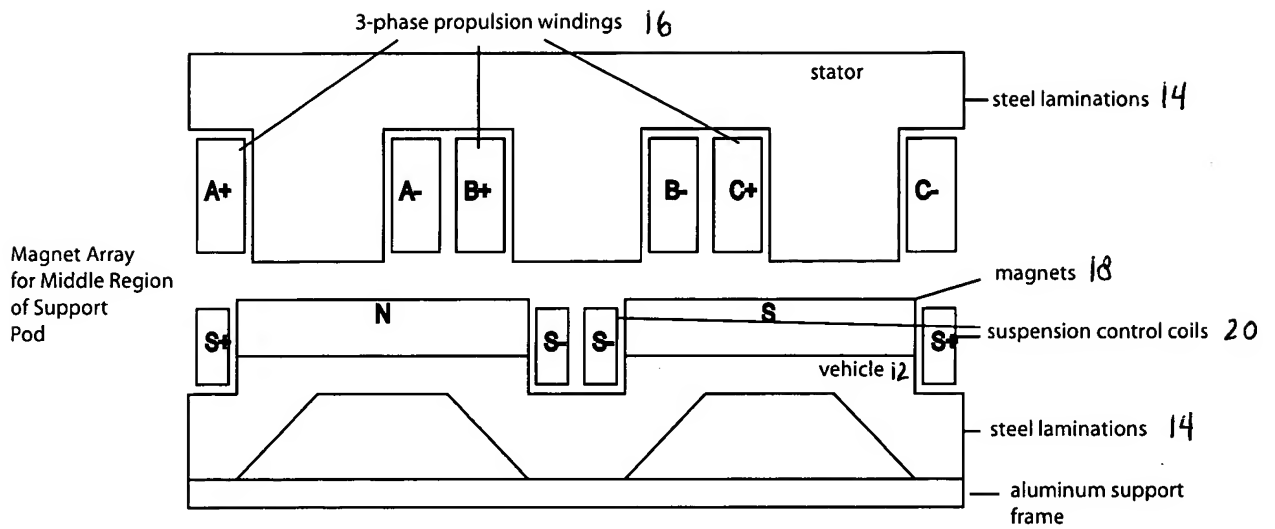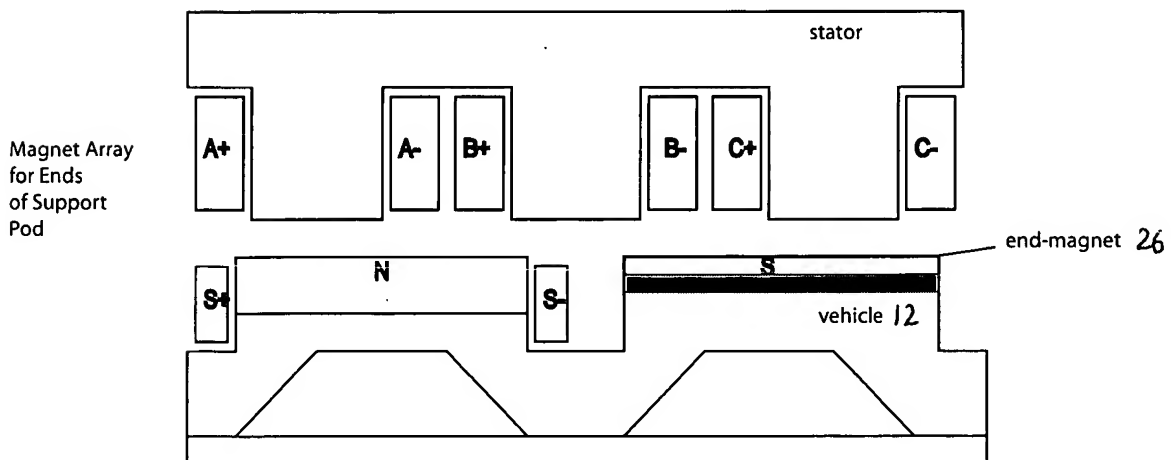
10

2000 to 3200 mm

vehicle body 12

{ laminated steel rails 14
with propulsion windings 16

{ permanent magnets 18
and control coils 20

1700 mm

box beam - height adjusted
according to span 22

24

Figure 1

3-phase propulsion windings 16

stator

steel laminations 14

| A+ | | A- | B+ | | B- | C+ | | C- |

Magnet Array
for Middle Region
of Support
Pod

magnets 18

| S+ | N | | S- | S- | S | | S+ |

suspension control coils 20

vehicle 12

steel laminations 14

aluminum support frame

Figure 2a

stator

| A+ | | A- | B+ | | B- | C+ | | C- |

Magnet Array
for Ends
of Support
Pod

end-magnet 26

| S+ | N | | S- | | S |

vehicle 12

Figure 2b

Note: Fill color has been removed from the drawings.

Figure 3

Figure 4
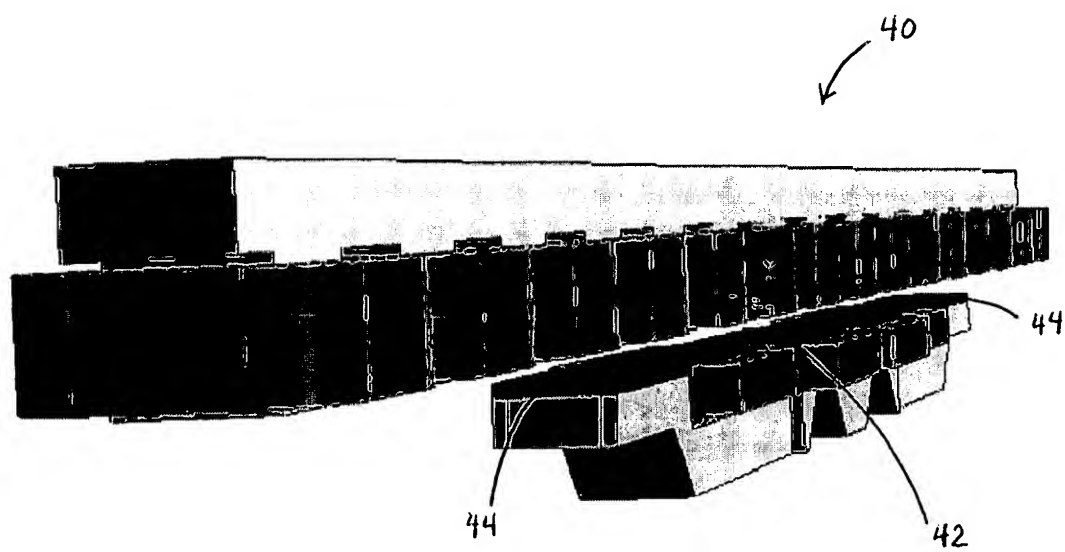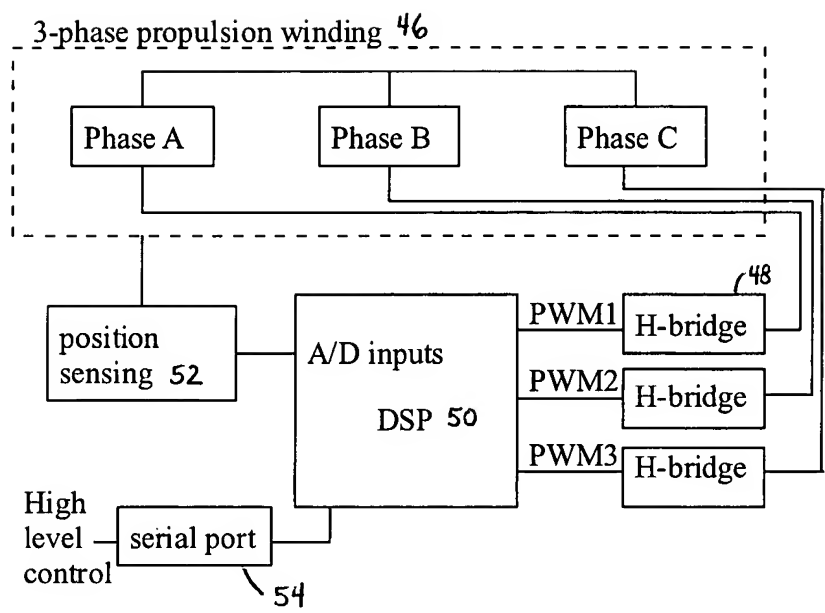
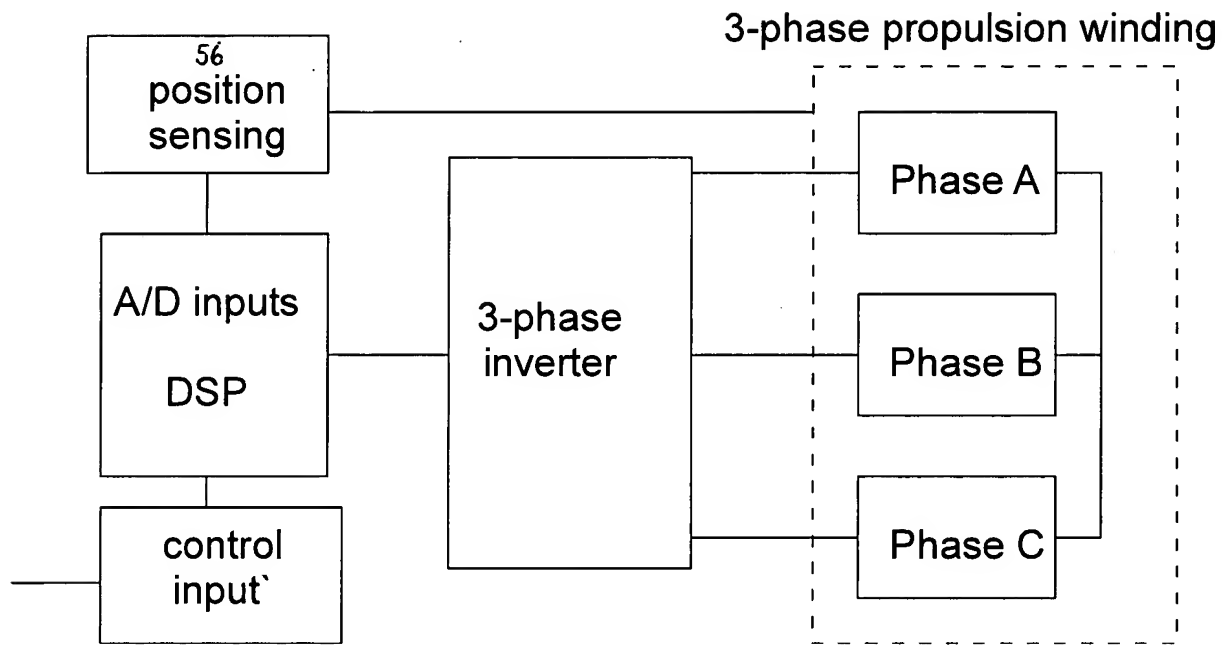3-phase propulsion winding 46

| Phase A | Phase B | Phase C |

position sensing 52	A/D inputs	PWM1	H-bridge	48
	DSP 50	PWM2	H-bridge	
		PWM3	H-bridge	

High
level — serial port
control
54

Figure 5

3-phase propulsion winding

56 position sensing		
A/D inputs DSP	3-phase inverter	Phase A
control input`		Phase B
		Phase C
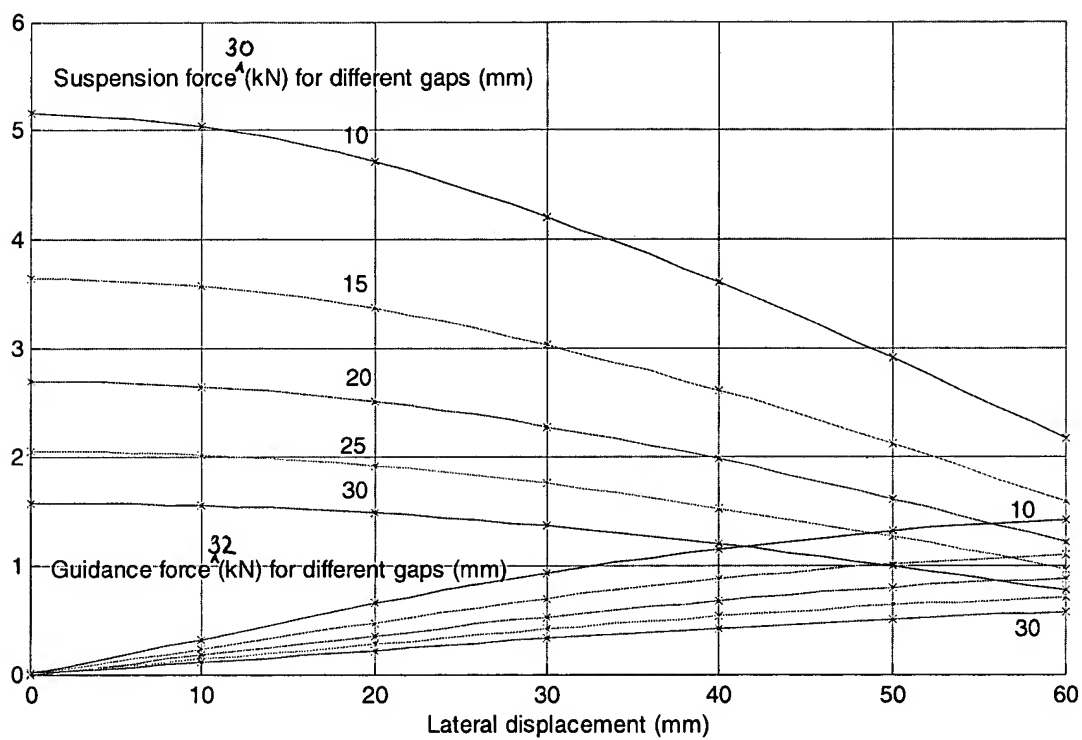
Figure 6

Figure 7

Figure 8